



Selected topics for the matchmaking process for environmental and sustainability research and innovation

CASRI Deliverable 3.2

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Collaborative Action coordinating and enhancing systemic, actionable and transversal Sustainability Research and Innovation

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EXECUTIVE SUMMARY

The objective of this CASRI Deliverable 3.2 is to present selected topics for collaborative European environmental and sustainability research and innovation (ES R&I) funding. The selected topics are primarily aimed at serving the matchmaking process between potential R&I funders at European and national levels. The selection also is the basis for the formation of the CASRI Strategic Research and Innovation Agenda (SRIA).

The topics represent transnational commons, i.e. priorities in ES R&I needs and challenges relevant for Europe or shared by several countries or regions in Europe. The shortlisted topics are selected from an extensive set of R&I priorities identified through a co-creation process and a workshop including experts from fourteen European countries and regions. The selected topics are further modified and refined based on insights from literature and expert evaluation. The criteria for the selection of topics included their transnational importance for sustainability transition, policy relevance and potential to establish transnational funding.

The topics are organized under a framework of four key environmental and sustainability themes and four themes representing key societal challenges. The environmental and sustainability themes are: Resilient, net-zero, circular production systems; Biodiversity and climate; Sustainable urbanisation; and Nature, environmentally and socially friendly energy transition. The societal challenges are: Security; Democracy and participation; Regulatory efficiency and competitiveness; and Digitalisation. The twenty shortlisted topics include the following:

- Security of resource supply
- Equity and actor influence
- Innovation for resilient, net-zero, circular production systems
- Integrated data-driven climate and biodiversity policies
- Effectiveness of climate policy
- Comprehensive and timely biodiversity monitoring
- Green space provision
- Land use and sustainable mobility
- Achieving social inclusion and assessing social impact

- Governance of nature-, environmentally and socially friendly energy transition
- Societal Engagement
- Comparing scenarios
- Comprehensive data security
- Social vulnerabilities of multi-scaled climate adaptation
- Inclusive science-policy-practice interface
- Integrating environmental and health data for socially just urban transformation
- Smart, adaptive and effective regulation
- Governance for sustainable competitiveness
- Capacities for advanced data generation and responsible utilisation
- Environmental sustainability of digital transformation

KEYWORDS

Environment, Funding, Innovation, Prioritisation, Research, Sustainability, Transition

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ABBREVIATIONS

AI	Artificial Intelligence
B&C	Biodiversity and Climate
EC	European Commission
EEA	European Environment Agency
EGD	European Green Deal
ES R&I	Environmental and Sustainability Research and Innovation
EPA	Environmental Protection Agency
EU	European Union
HEU	Horizon Europe
NEFET	Nature & Environmentally Friendly Energy Transition
NESFET	Nature, Environmentally & Socially Friendly Energy Transition
NKS	National Key Stakeholders
R&I	Research and Innovation
RNZCPS	Resilient, Net-Zero, Circular Production Systems
SDGs	Sustainable Development Goals
SPPI	Science, Policy and Practice Interaction
SRIA	Strategic Research and Innovation Agenda
SU	Sustainable Urbanisation

Selected topics for the matchmaking process for environmental and sustainability research and innovation

1. Introduction

1.1 Aim and background

This report aims to present a set of shortlisted topics for European environmental and sustainability research and innovation (ES R&I). The topic descriptions are based on selected transnational key issues originating from the data collected by the CASRI project. These topics are primarily intended to support the CASRI matchmaking process with potential R&I funders at European and national levels. The selection also informs and supports the development of the CASRI Strategic Research and Innovation Agenda (SRIA).

Figure 1 highlights key features of the CASRI project. The project is strongly grounded in a science-based understanding of environmental and sustainability issues, as illustrated by the green gradient in the figure. The project builds on reliable, science-based knowledge of past developments and also aims to anticipate uncertain future knowledge needs. It relies heavily on the perspectives of expert stakeholders who identify R&I priorities within diverse national and regional contexts. The project is also responsive to concerns from society, policymakers, and the economic and financial sectors.

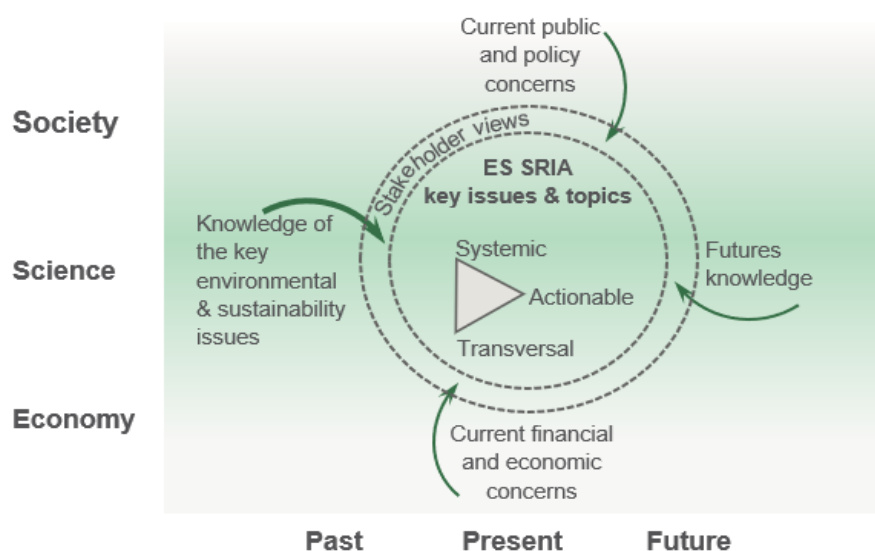


FIGURE 1 – POSITIONING OF THE CASRI ENVIRONMENTAL AND SUSTAINABILITY SRIA

The topics were identified through data collected from extensive stakeholder engagement across 14 European countries and regions (Firus et al. 2024; Maring et al. 2025). This data initially presented over 600 research and innovation priorities, deemed socially, economically, and ecologically relevant by national key stakeholders. These priorities reflect current scientific understanding of key

environmental and sustainability issues, address current policy concerns, and consider economic factors and anticipated future challenges. The data were screened to identify transnational themes and potential key issues for ES R&I, and an expert workshop was arranged to discuss and prioritize them (Lyytimäki et al. 2025a). The resulting key issues address the systemic, actionable, and transversal knowledge needs of the forthcoming CASRI SRIA.

This report details the next stage of the prioritisation process, identifying a focused set of topics for matching with potential R&I funders. We have organised these topics within the thematic framework established in the previous CASRI D3.1 (Lyytimäki et al. 2025a), which includes four key environmental and sustainability themes and four cross-cutting themes representing significant societal challenges.

The four environmental and sustainability themes as preselected in CASRI – alongside an open theme for other potential issues – guided data collection and stakeholder engagement during the first phase of the CASRI project (Maring et al. 2025; Figure 2). These themes are:

- Resilient, net-zero, circular production systems;
- Biodiversity and climate;
- Sustainable urbanisation;
- Nature and environmentally friendly energy transition.

The four societal challenges were added to the framework based on the initial screening and analysis of the collected data. They address questions related to:

- Security;
- Democracy and participation;
- Regulatory efficiency and competitiveness;
- Digitalisation.

Together the two lists create a matrix of 4x4 themes. The themes intersect and overlap, reflecting the complexity and intertwined nature of sustainability transitions.

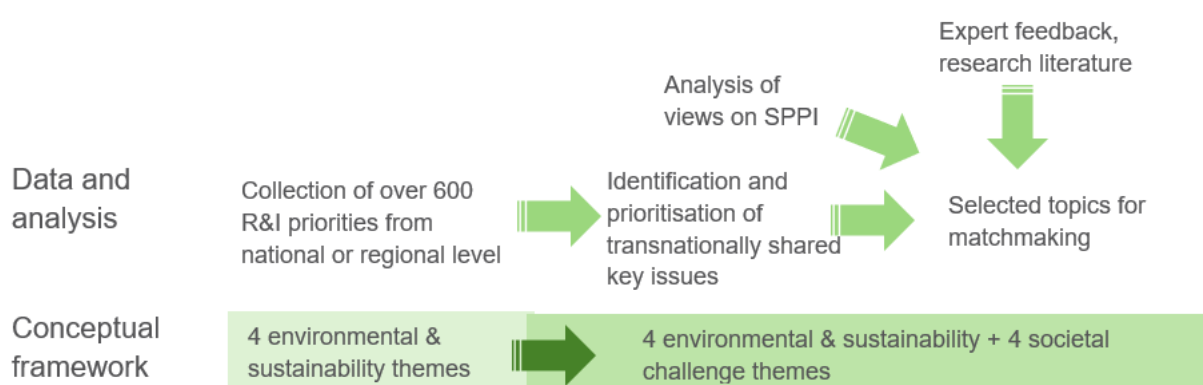


FIGURE 2 – SUMMARY OF THE SELECTION PROCESS OF ES R&I TOPICS FOR MATCHMAKING

1.2 Criteria and descriptions for selecting the topics

This section outlines the criteria and descriptions used to select a focused set of topics to support targeted matchmaking with potential funders and to inform the development of the CASRI Strategic Research and Innovation Agenda (SRIA). The descriptions of the selected topics are drawn from

key issues identified in CASRI D3.1 “Transnational shared common themes for environmental and sustainability research and innovation” (Lyytimäki et al. 2025a).

The selection of topics was guided by the following criteria, ensuring alignment with previous CASRI project phases and contributing to sustainability transitions (EEA 2019):

- Alignment with the CASRI themes: the topics collectively cover the eight themes identified in earlier project phases.
- Addressing knowledge needs: each topic addresses actionable, systemic, and transversal knowledge needs—as defined in the CASRI triangle (Maring et al. 2025).
- Future relevance: the selected topics aim to highlight areas that are either under-addressed by existing funding streams or that tackle neglected aspects.
- European scope & local sensitivity: the topics possess high societal and policy relevance across Europe, while remaining sensitive to regional and local contexts.
- Transnational importance: issues with relevance only to a single country were excluded; emphasis was placed on topics with recognised transnational importance.

To meet these criteria, descriptions of topics are crafted using the already identified key issues as a starting point. Topics may be directly selected, adapted, and enriched from the listings of transnational key issues presented in D3.1 (Lyytimäki et al. 2025a), or they may combine elements from two or more related key issues. Typically, topics aim to cover relatively wide areas of environmental and sustainability R&I and aggregate key issues together. Table 1 summarises the presentation format of the selected topics.

TABLE 1 – SUMMARY OF THE PRESENTATION FORMAT OF THE SELECTED TOPICS

Descriptive elements	“Title of the proposed topic”
Description of topic	The selected topic should be defined clearly and concisely
Contribution to E&S challenges	The topic should tackle one or several of the key environmental and sustainability challenges
Transnational societal and policy relevance	The topic needs to be relevant beyond a local level on cross-national, European or global level
Systemic knowledge needs	Capability to build empirical and theoretical multidisciplinary knowledge on systems behaviour and change
Transversal knowledge needs	Capability to build multi-level, multi-sector and multi-actor governance knowledge
Actionable knowledge needs	Capability to build knowledge that helps to implementing actual societal change

The topics are selected to broadly encompass various ES R&I fields, facilitating the identification of concrete project ideas and demonstrator concepts for ambitious sustainability research. A key focus is to identify areas where Environmental Protection Agencies (EPAs) or alike organisations, can contribute and demonstrate added value. Earlier deliberative approaches with the network of EPAs¹

¹ The knowledge needs are summarized based on notes from IG EPAS workshop in Vienna, Austria, April 2025 (Session 4: Transformation starts with us). For further information on IG EPAS (Interest Group on Sustainability Research and

revealed values that revolve around effective communication with broad audiences, building understanding of sustainability priorities and countering disinformation. The interpretations of the shortlisted topics are developed through this lens of creating narratives of engagement while grounded in science.

1.3 Selection of the shortlisted topics

The selection of topics draws from the R&I priorities and key issues identified in previous phases of the CASRI project. Many of the R&I priorities were described only briefly in the original data, leaving considerable room for interpretation. The selection should not be understood as a list of isolated topics. On the contrary, all themes and most of the topics are closely connected.

During the previous phase of the CASRI process, transnational key issues were both collected from the national level R&I priorities (Maring et al., 2024) and prioritised to their transnational potential (Lyytimäki et al. 2025a). This resulted in several adjustments to the originally collected data, amongst them:

- Resilient, net-zero, circular production systems: merging of two key issues into a single topic (Equity + Actor influence).
- Sustainable urbanisation: merging of two key issues “green space provision” with “climate adaptation”, as the goals aimed for are closely related.
- Nature and environmentally friendly energy transition (NEFET): On the one hand the merging of two key issues (“societal engagement” and “NEFET and social justice”) as well as the merging of aspects related to the “governance of NEFET” as pertaining to the four societal challenges of “Security”, “Democracy”, “Other”, and “Regulatory Efficiency”. The latter compilation of key issue aspects under the larger group of “governance of NEFET” is now committed to the cross-cutting theme “Regulatory Efficiency and Competitiveness”.

Although several topics received more representation in the data respective to other less mentioned topics, the selection of key issues was made by capping the total amount of key issues per CASRI environmental and sustainability themes. An arbitrary value of three topics was chosen for each of the original CASRI environmental and sustainability themes to keep the total amount manageable yet representative. The twelve topics cover just below 50% of total transnational contributions (73 key issues). The top three of the deducted key issues are considered as starting points for outlining and describing the shortlisted topics (see Figure 3).

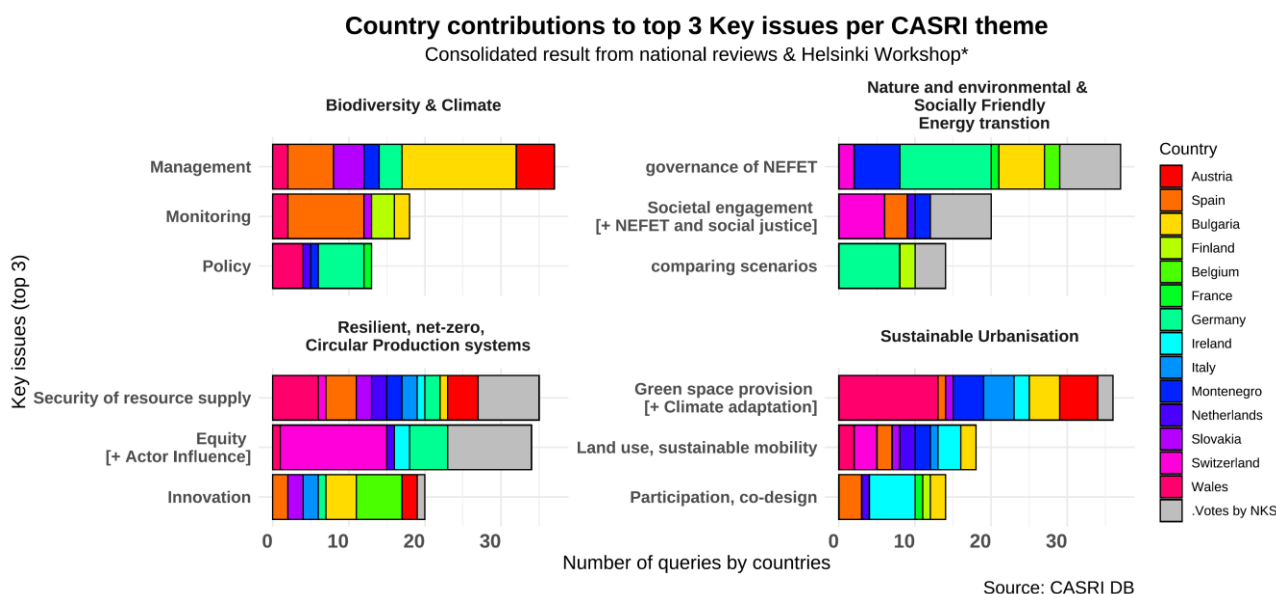


FIGURE 3 – RESULT OF REGROUPING, SORTING AND FILTERING THE TOP 3 OF IDENTIFIED KEY ISSUES THROUGHOUT THE CASRI PROCESS

*NOTE: GREY COLOUR REPRESENTS PRIORISATIONS BY NATIONAL KEY STAKEHOLDERS PRESENT IN HELSINKI WORKSHOP (SEE LYYTIMÄKI ET AL. 2025A).

Additionally, to supplement the 12 topics under the four sustainability challenge themes, it was decided to develop a maximum of two topics for each of the four cross-cutting societal challenge themes, which added up to $(2 \times 4 =) 8$ additional topics. For outlining the cross-cutting societal challenge themes, a more qualitative approach was adopted, aimed in particular to identify potential latent topics. This resulted in a maximum of 20 topics for further consideration within the CASRI SRIA process.

1.4 Formulating descriptions

To elaborate the topic descriptions, different approaches were employed. First, qualitative interpretation was required for the integration of transnational key issues as formulated in CASRI D3.1 (Lyytimäki et al. 2025a) as well as for inclusion of internal comments (the CASRI Core Group and the International Advisory Board).

Second, the initial selection of topics informed the formulation of a separate policy brief document (Bartke & Uhel 2025). The draft of this document was discussed in a workshop (IG EPAS workshop, Cardiff, 14 October 2025) involving representatives from five European Environmental Protection Agencies and the chair of the EEA's Scientific Committee. In turn, these discussions informed the further elaboration of the topics proposed here.

Third, building from the CASRI D2.1 (Maring et al. 2025), results from the separate analysis of the Science-Policy-Practice-Interface (SPPI) (Lyytimäki et al. 2025b) are noted under the societal challenge theme “Democracy and Participation”. Qualitative interpretations by the authors of this report aimed to ensure that all potentially relevant underlying considerations for the cross-cutting societal themes were identified.

2. Suggested topics for matchmaking

This section summarises the selected key topics identified as the most relevant ones under the thematic framework outlined in CASRI project. For further details of national level priorities and specific transnational key issues, see previous CASRI reports (Maring et al. 2025; Lyytimäki et al. 2025a). To keep the matchmaking process focused the number of topics was limited to 20. Under each of the environmental and sustainability theme (chapters 2.1–2.4), three topics are presented and under the societal challenge themes (chapters 2.5–2.8), two topics.

2.1 Resilient, net-zero, circular production systems

2.1.1 Security of resource supply

Recent European policy discourse has set the tone towards enhanced competitiveness and security, with less explicit attention to decarbonisation, social cohesion and territorial, place-based development. However, the expressed vision towards gaining and securing that competitive advantage and maintaining economic, social and environmental resilience is through upscaling Europe's resource and material efficiency. As stated by Ursula von der Leyen, president of the European Commission: “[.] the only answer here is creating a truly circular economy” (SOTEU 2025). Throughout the CASRI process this topic has been significantly underscored across all participating regions (Table 2).

TABLE 2 – SECURITY OF RESOURCE SUPPLY

Proposed topic	Security of resource supply
Description	Security of resource supply collates all the expressed knowledge needs that cover securing the productivity of (trans)national industries and functionality of the European single market (for existing and infant industries). The topic covers innovation needs related to efficiency improvement, regenerative materials and substitutes.
Contribution to E&S challenges	The topic addresses predominantly the circular economy E&S challenge through an economic and territorial resilience lens. EPAs have a special role to overcome the narrow framing to ensure that environmental sustainability is addressed broadly.
Transnational societal and policy relevance	The topic connects local level needs with (trans)national dependencies. As a result, while accounting for the subsidiarity principle, it intertwines with European and global processes.
Systemic knowledge needs	(Technological) progress in, and estimating impacts from, required systemic changes that advance (trans)national sovereignty. Including but not limited to e.g. • Regenerative (bio)economy; • Resilience and shock prevention; • Deducting critical resource needs; • Diversification of fuelling, feedstock or sourcing.
Transversal knowledge needs	Knowledge needs that look into monitoring risks, potentials, maturities, dispositions and how those affect (political) agendas. Including but not limited to e.g. • Influence of concerns around resource supply on (political) agendas;

	• Appropriate policy instruments supporting the desirable systems.
Actionable knowledge needs	Deducting key application areas (specific industries, tools). Including but not limited to e.g. • Reduction of (energy) demand in specific sectors; • Specific tools to balance energy fluctuations from renewable energy sources.

2.1.2 Innovation for resilient, net-zero, circular production systems

The topic “innovation for resilient, net-zero, circular production systems” (Table 3) covers the breadth of traditional innovation challenges to maintain a robust and competitive (trans)national economy. Innovations other than reducing dependencies on foreign entities (section 2.1.1.) belong here (e.g. focusing on climate mitigation, pollution, health). Challenges encompass accelerating the rate of change and developing appropriate contexts for sustainable development. Scaling has also been underscored by Ursula von der Leyen as president of the European Commission by stating “*We now need to speed up with the implementation*” (SOTEU 2025).

TABLE 3 – INNOVATION FOR RESILIENT, NET-ZERO, CIRCULAR PRODUCTION SYSTEMS

Proposed topic	Innovation for resilient, net-zero, circular production systems
Description	Accelerating the development of sustainable transboundary production systems.
Contribution to E&S challenges	This topic addresses the traditional environmental and social challenges inherent in (inter)national production systems through a more physical and technologically driven transformation lens.
Transnational societal and policy relevance	Innovation programs are often developed within a national context, while many production systems operate on international scales. This topic aims to improve guidance and support for transboundary innovation systems.
Systemic knowledge needs	Systemic knowledge needs encompass technological innovation and development areas for specific sectors and value chains. Key areas include but are not limited to: • Developing industrial flexibility; • Infrastructural changes; • Integrated energy systems – particularly green hydrogen technologies; • Strengthening innovation ecosystems through enhanced collaboration; • Pollution prevention through strategies like Safe & Sustainable by Design (SSbD); • Soil remediation for emergent contaminants; • Construction (low-carbon materials and green buildings); • Farming and food systems.
Transversal knowledge needs	Creating awareness and streamlining the adoption of innovations across systems and value chains.
Actionable knowledge needs	Adoption of innovations at application sites.

2.1.3 Equity and actor influence

The topic covers all concerns relating to a just and fair transition when aiming towards Resilient, net-zero, circular production systems (Table 4). As advised by the NKS at the transnational CASRI workshop (see D3.1, Lyytimäki et al. 2025a) the key issue “Equity” is here considered in conjunction with the key issue “Actor Influence”. Social aspects have also been emphasised by Ursula von der Leyen, president of the European Commission: “This is why the transition must support people and strengthen industry” (SOTEU 2025). Throughout the CASRI process this topic has been perceived as the one with the greatest transnational potential (greatest number of votes) across the participating stakeholders at the transnational stakeholder workshop.

TABLE 4 – EQUITY AND ACTOR INFLUENCE

Proposed topic	Equity and actor influence
Description	This topic integrates all expressed knowledge needs related to understanding structural change and the behaviours and conditions for just and fair transition towards resilient, net-zero, circular production systems.
Contribution to E&S challenges	The topic addresses environmental and sustainability challenges through various social dilemma lenses that affect the course of action and how this action is perceived.
Transnational societal and policy relevance	The topic addresses power imbalances between (multinational) actors and how to create fair and leveled playing fields across sectors and beneficiaries.
Systemic knowledge needs	Knowledge needs include but are not limited to the development of anticipatory governance knowledge around: • Positive and negative social, political, institutional impacts (e.g. social disparities, benefits) from structural change; • Responses (e.g. resistance, cross-cutting collaboration) to structural change.
Transversal knowledge needs	Expressed transversal knowledge needs included applying just transition lenses in designing strategies that enable knowledge transfer, capacity building and management.
Actionable knowledge needs	Facilitating enabling conditions and reducing barriers (e.g. promoting equitable wealth and resource distribution) and incentivising appropriate responsible behaviours.

2.2 Biodiversity and climate

2.2.1 Integrated data-driven climate and biodiversity policies

The topic “Integrated data-driven climate and biodiversity policies” (Table 5) addresses the crucial need to understand the interactions between climate change and biodiversity loss – a fundamental requirement for achieving a sustainability transition. While both climate change and biodiversity loss

are widely recognized as critical global challenges, stakeholders consistently identified the need for a better understanding of their interconnectedness, particularly for enabling data-intensive, integrated policy action. This topic emphasizes key integrative elements, including data utilization, governance of climate–biodiversity interactions, and regulatory and institutional frameworks for effective policy implementation. Ecological restoration and enhancing the resilience of soil, water, and forest ecosystems are vital components of integrated climate and biodiversity actions.

TABLE 5 – INTEGRATED DATA-DRIVEN CLIMATE AND BIODIVERSITY POLICIES

Proposed topic	Integrated, data-driven climate and biodiversity policies
Description	Generation and utilisation of climate and biodiversity data to identify and manage interconnected policy opportunities and risks.
Contribution to E&S challenges	Both climate change and biodiversity are widely studied, but their intersections have received less attention. The existing data is likely to provide 'low-hanging fruit' for the identification of synergistic policy actions addressing both challenges. Possibilities to avoid unintended policy outcomes from isolated policy actions or non-action.
Transnational societal and policy relevance	Development of innovative monitoring methods and enhanced use of spatial data integrating ecosystems, soil and water for detecting biodiversity–climate interactions. Identification of interconnected risks, long-term cascading effects and potential thresholds. Awareness creation on biodiversity–climate interactions, education and participation (e.g. land use).
Systemic knowledge needs	Focuses on interactions between different systemic issues and policy fields. Systemic assessments of combined effects of climate and biodiversity policies as well as the effects of climate and biodiversity policies to other challenges
Transversal knowledge needs	Cross-sectoral integration across different scales of activity. Connects understanding of global environmental changes with regional and local data for effective planning and decision-making.
Actionable knowledge needs	Guiding action in already established policy fields towards more integrative approaches. Recognising the potential cross-cutting effects of action and non-action.

2.2.2 Effectiveness of climate policy

Climate change and biodiversity loss are specific challenges with different knowledge needs. Related to climate change, challenges related to the effectiveness of climate policy stood out as the major topic (Table 6). Climate policy was recognised as an already well-established policy area with considerable implementation gaps and a need for knowledge focusing on means to close those gaps. Earlier research has noted the lack of funding directed to social science investigations of climate-change and energy transition as well (Overland & Sovacool 2020).

TABLE 6 – EFFECTIVENESS OF CLIMATE POLICY

Proposed topic	Effectiveness of climate policy
Description	Regulatory frameworks and policy implementation for effective climate action
Contribution to E&S challenges	Tackling climate change with social science approaches. Developing comprehensive, consistent and applicable long-term pathways to climate neutrality, in a societal context focusing public and policy attention to other pressing social problems and economic goals.
Transnational societal and policy relevance	National and international implementation of science-based climate policies, including economic instruments and finance. Management of synergies and conflicts related to different policy options. Justness of climate adaptation, preparedness and resilience across different scales and actor groups.
Systemic knowledge needs	Relationship between climate mitigation and adaptation, opportunities related to ecosystem-based climate mitigation, cross-sectoral climate governance. Addressing relationships between climate action and other policy goals.
Transversal knowledge needs	International level climate goals and national and local level implementation. National EPAs may have a special role as boundary organisations between global and local levels.
Actionable knowledge needs	Need for R&I to design and implement more effective national climate adaptation and mitigation plans.

2.2.3 Comprehensive and timely biodiversity monitoring

Focusing on biodiversity, comprehensive and timely monitoring for understanding ecosystem change emerged as the prioritised topic (Table 7). The importance of environmental monitoring was also emphasised, relating it to other issues, noting that data collection must be followed by knowledge generation and policy action (see Chapter 2.8.2).

TABLE 7 – COMPREHENSIVE AND TIMELY BIODIVERSITY MONITORING

Proposed topic	Comprehensive and timely biodiversity monitoring
Description	Comprehensive, up-to-date, and policy-relevant ecosystem monitoring to create a better understanding of biodiversity change
Contribution to E&S challenges	Addressing fundamental knowledge deficits: Biodiversity monitoring programmes remain scattered, often unable to provide timely information. Several data gaps exist.
Transnational societal and policy relevance	Development of more comprehensive, coherent, up-to-date, policy-relevant biodiversity monitoring. Special attention to capabilities for: • Use of spatial data; • Aquatic biodiversity and management of water ecosystems; • Genetic diversity; • Soil biodiversity in natural and managed lands; • Monitoring and management of invasive species.

Systemic knowledge needs	Continuous accumulation of biodiversity monitoring data as a fundamental basis for understanding ecosystem functioning.
Transversal knowledge needs	Development of interfaces between different monitoring systems in national and European levels. Special opportunity for EPAs to serve as hubs of knowledge generation.
Actionable knowledge needs	Capacities to provide comprehensive and timely information for decision making. Citizen science approaches provide opportunities for actionable knowledge creation.

2.3 Sustainable urbanisation

2.3.1 Green space provision

The topic of green space provision (Table 8) derived from the research and innovation priorities collected by CASRI lies in finding solutions for more resilient urban areas, primarily through urban green and nature-based solutions. Knowledge needs include those related to coordinating stakeholders and scaling up the provision of ecosystem services (e.g. soil, rainwater capture, retention and reuse, prevention of urban heat islands) in areas in dire need of climate adaptation.

TABLE 8 – GREEN SPACE PROVISION

Proposed topic	Green space provision
Description	This research and innovation topic seeks to provide additional arguments and thematic connections to convince decision-makers to allocate resources and support initiatives aimed at increasing green spaces in urban areas. These are recognized to positively impact urban well-being and contribute to climate adaptation against weather extremes. At the site-specific level, future research could focus on addressing disturbed or contaminated soils in urban areas. Further, research on how to maximize environmental (biodiversity, climate resilience) and social (health, community engagement) benefits is of focus. Methods for research mentioned include living labs, with prioritization given to nature-based vs. technical solutions.
Contribution to E&S challenges	Land use decisions and changes significantly impact urban environments and quality of life. This research demand calls for a comprehensive and integrated approach to combine sectoral perspectives and achieve a more holistic understanding of the drivers, pressures and levers of change. The goal is to optimize land use for sustainable urban development through integrative thinking and policy design, alongside adequate data collection and monitoring. CASRI insights note the need for a better understanding of transformative change, requiring deeper insight into the processes of organizational, social, and behavioural shifts related to drivers of land use change, alongside improved utilization of data – including artificial intelligence, participatory citizen science, visioning exercises, and awareness-raising initiatives. The reconfiguration of the economy, incorporating considerations of sufficiency and justice, sustainable consumption, sustainable finance, incentives and

	disincentives for action, and regenerative economic paradigms, were also highlighted.
Transnational societal and policy relevance	This topic incorporates feedback from across CASRI themes. For sustainable urbanization, the key issue of “land use and sustainable mobility” was prioritized highly. Similarly, within the biodiversity and climate theme, a better understanding of systemic interactions between different environmental challenges was stressed, addressing potential trade-offs and synergies – extending beyond biodiversity and climate-related activities. These key findings from both themes underscore the importance of an integrative approach to achieve innovative results. Furthermore, for the NESFET theme, “land use” was highlighted not only as a thematic priority but also as an integrative platform for exploring interlinkages.
Systemic knowledge needs	Addresses Green Deal goals (pollution-free environments, climate adaptation, biodiversity) with needs of integrated sectoral planning (city planning, energy and blue-green infrastructure, etc.).
Transversal knowledge needs	Involves the interplay between EU policies (e.g. Renewable Energy Directives, Nature Restoration Law) and activities by national agencies (e.g. EPAs often as monitors of national land use changes and trends).
Actionable knowledge needs	Outputs include pilot-tested data tools, use cases, policy guidance.

2.3.2 Land use and sustainable mobility

Sustainability-oriented spatial urban development calls for integrative thinking between established sectors. This was made clear in CASRI with focus being set on the interlinkages of land use and mobility sectors (Table 9). The expected impacts on social, environmental and economic criteria play an important role as well. The development and understanding of scenarios can help coordinate sustainable development, from the building site level all the way to the regional, national and European level.

TABLE 9 – LAND USE AND SUSTAINABLE MOBILITY

Proposed topic	Land use and sustainable mobility
Description	For the regional spatial impact of transport decisions, a focus was placed on the synergies offered by transport (primarily the transport of people, and in some cases freight) with other land use concepts, such as land use efficiency, reduction of land take, and the implementation of “sponge city” principles. There was explicit recognition of the need to understand the impact of permitting processes, such as zoning, on issues of land take, and how to balance transport with land use.
Contribution to E&S challenges	This knowledge demand aims to contribute to understanding the broader societal impact of land use decisions on settlement structures. For example, the impact of transport choices on public health and the achievement of climate neutrality.

Transnational societal and policy relevance	Climate neutrality goals are of high priority for society. Some CASRI insights highlighted the need to progress towards this objective, while also recognizing that physical infrastructure must support climate-neutral living. This requires a greater integration of mobility and land use fields, and widespread acceptance. CASRI data point towards promising methods of co-design and participation of civil society in developing feasible solutions due to the central role of the general population when it comes to influencing transportation patterns.
Systemic knowledge needs	Knowledge demands focus on the interplay between land use and mobility, and a need for innovative concepts to address evolving conditions, such as democracy crisis (e.g. populism) and climate change. A central question is how to integrate emerging land use needs, related to renewable energies and climate adaptation, into settlement structures that also support sustainability.
Transversal knowledge needs	Understanding the impact of local actions while adapting or creating supportive national and international frameworks is crucial—essentially mainstreaming effective solutions.
Actionable knowledge needs	Developing demonstrator sites for improved quality of life, building coalitions, and engaging communities are essential steps forward.

2.3.3 Achieving social inclusion and assessing social impact

Knowledge demands for the theme of sustainable urbanisation stress the need for direct engagement with society through innovative means. Sustainable lifestyle choices can be supported by the contextual and regulatory setting as well as be a product of individual choices. On the one hand, there is a call for the comparison and operationalization of social innovation methods (co-design, co-management) for improved objective achievement. On the other hand, potential is seen in addressing consumption patterns of societal groups to help support sustainable lifestyle choices e.g. reducing car dependency and inefficient land use decisions. EPAs are vital to addressing the various points of this topic in their function as multipliers to various national, regional and local target groups (e.g. through consortium projects but also through strategic initiatives) as well as being general informer and supporter of sustainability initiatives (e.g. through general information campaigns and publications).

TABLE 10 – ACHIEVING SOCIAL INCLUSION AND ASSESSING SOCIAL IMPACT

Proposed topic	Achieving social inclusion and assessing social impact
Description	This topic aims to better integrate social preconditions and needs when pursuing projects relevant to sustainable urbanisation. This can include adapting co-design and co-management methods when carrying out projects, and highlighting social perspectives within dedicated research fields.
Contribution to E&S challenges	The focus is on engaging communities to establish them as active participants in sustainability research, thereby addressing existing disengagement and opposition. It looks to address both the contextual and regulatory setting in which initiatives are carried out to better address social

	needs as well as provide support in the form of knowledge or solutions for sustainable lifestyle changes.
Transnational societal and policy relevance	Social aspects, such as inclusion and co-design, are increasingly emphasised by the New European Bauhaus initiative (NEB) of the EU and the related EU Mission/NEB Facility. Further relevance is given to the objectives of cohesion between EU regions, as defined by Cohesion Policy and the related funding schemes (e.g., European Social Fund+).
Systemic knowledge needs	This topic calls for the integration of various disciplines to better understand community interests and impacts. It prioritises social equity, integrative thinking, and action, involving society in concepts such as climate adaptation and sponge cities. It also addresses the digitalisation of urban services and the creation of better data governance, alongside the essential social preconditions for successful inclusion.
Transversal knowledge needs	Knowledge exchange between different levels is crucial. Understanding the role of engagement, co-design, and co-management as means to achieve desired transformational impacts is paramount, as is aligning interests across various levels. European cohesion remains a key objective.
Actionable knowledge needs	Empowering communities, developing co-creation processes, and reaching consensus are essential. Encouraging interdisciplinary discussions—such as incorporating “Do No Significant Harm” perspectives into urban decision-making—will be vital.

2.4 Nature, environmentally and socially friendly energy transition

2.4.1 Governance of nature-, environmentally and socially friendly energy transition

While the nature friendly energy transition is well established in scientific and political discourse, its societal dimension requires greater attention. The theme is characterised by conflicting goals and the clash of different interests. It is therefore a central task to provide transparency and to contribute towards creating acceptance within the population and to identify synergies. The current lack of trust in politics poses a significant challenge to implementing a socially and environmentally just energy transition. There is a greater need for dialogue and negotiation processes with civil society actors who are close to the needs and concerns of the population. Societal engagement is key to building support in the society, encouraging behavioural change, and ensure a fair and equitable transition, particularly for vulnerable groups. By strengthening governance and stakeholder coordination at the regional level, the transition can be better aligned with broader goals such as reducing energy poverty and promoting social justice.

TABLE 11 – GOVERNANCE OF NATURE-, ENVIRONMENTALLY AND SOCIALLY FRIENDLY ENERGY TRANSITION

Proposed topic	Governance of nature-, environmentally and socially friendly energy transition
Description	Governance of nature-, environmentally and socially friendly energy transition refers to the frameworks, policies, and collaborative mechanisms needed to

	coordinate stakeholders, create effective regulatory and incentive systems, and ensure transparency and participation. It emphasises cross-border cooperation, democratic decision-making, and long-term resilience, balancing ecological, social, and economic dimensions in guiding the energy transition.
Contribution to E&S challenges	Governance of nature-, environmentally, and socially friendly energy transition contributes to addressing challenges by providing transparent and inclusive frameworks that balance ecological protection, social justice, and economic resilience. It supports the integration of renewable systems, fosters cross-border cooperation, and ensures that the transition is both just and sustainable for present and future generations.
Transnational societal and policy relevance	It is highly relevant for both society and policy as it ensures inclusive participation, strengthens democratic legitimacy, and builds public trust in the transition process. By providing effective regulatory frameworks and coordinated policies, it enables a fair distribution of benefits and burdens, addresses energy poverty, and aligns national and regional strategies with broader sustainability goals.
Systemic knowledge needs	How to link Green Deal goals (e.g. climate neutrality) to social aspects.
Transversal knowledge needs	How to connect EU-level regulation with national agencies and local implementation by municipalities, companies and citizens. Focus on multi-level-governance.
Actionable knowledge needs	Pathways for combining social aspects and targeted support for implementation at the local level.

2.4.2 Societal engagement

Societal engagement is key to building support within society, encouraging behavioural change, and ensure a fair and equitable transition, particularly for vulnerable groups. By strengthening governance and stakeholder coordination at the regional level, the transition can be better aligned with broader goals such as reducing energy poverty and promoting social justice (Table 12). Achieving this requires effective governance frameworks that ensure coordination, regulatory efficiency, and cross-border cooperation.

TABLE 12 – SOCIETAL ENGAGEMENT

Proposed topic	Societal engagement
Description	Societal engagement refers to the active involvement of citizens, communities, and stakeholders in shaping the energy transition process. It encompasses fostering public awareness, encouraging behavioural change, and creating inclusive spaces for dialogue and co-design. By strengthening participation and democratic practices, societal engagement helps to build trust, ensure social acceptance, and promote equitable and sustainable energy solutions. Examples such as renewable energy communities demonstrate how collective action can strengthen local participation, as energy communities go beyond

	electricity sharing by promoting democratic participation, social inclusion, and environmental responsibility.
Contribution to E&S challenges	Key challenges include public disengagement and disinformation as well as and insufficient public involvement in the energy transition. Strengthening societal engagement is therefore essential.
Transnational societal and policy relevance	Understanding the political implications and factors influencing social acceptance, as well as promoting more sustainable energy generation through public support and participation, is highly relevant. Equally important is exploring ways to foster new eco-social energy solutions through active societal engagement, thereby strengthening the overall energy transition.
Systemic knowledge needs	How to link Green Deal goals (e.g. climate neutrality, biodiversity, climate adaptation, circularity) to social justice aspects, recognising that societal engagement can contribute to procedural justice. This requires attention to systemic factors shaping engagement, including societal structures, dynamics, and barriers that influence participation across regions.
Transversal knowledge needs	How to involve EU policy, national agencies (e.g. EPAs), and cities as well as municipalities to ensure societal engagement and learn from each other—how social engagement contributes to achieving environmental and climate goals.
Actionable knowledge needs	Practical options for action are needed at all levels of governance, such as roadmaps for participation, use cases and policy guidelines for social engagement, in order to ensure participation and thus enable a socially acceptable energy transition.

2.4.3 Comparing scenarios

Nature, environmentally and socially friendly energy transition must integrate technological, social, environmental, and economic perspectives in a balanced and future-oriented way (Table 13). Only such a comprehensive approach can secure long-term sustainability.

TABLE 13 – COMPARING SCENARIOS

Proposed topic	Comparing scenarios
Description	Comparing scenarios focuses on foresight and the identification of key levers for change in the energy transition. It explores how scenario analysis can inform strategic decisions by highlighting ecological risks, trade-offs, and long-term sustainability pathways beyond 2030. Central research needs include developing effective methodologies to evaluate the environmental and social costs and benefits of different transition options and understanding the implications of action versus inaction. Robust scenario planning is therefore essential to ensure ecological resilience and to guide policy and investment choices towards a more sustainable energy future.
Contribution to E&S challenges	Comparing scenarios contributes to addressing environmental and sustainability challenges by enabling policymakers and stakeholders to anticipate risks, weigh ecological trade-offs, and identify robust pathways for

	the energy transition. Through foresight and systematic evaluation, it supports informed decisions that balance environmental integrity, social acceptance, and long-term resilience of the energy infrastructure beyond 2030.
Transnational societal and policy relevance	Comparing scenarios is highly relevant for society and policy as it enhances transparency in decision-making, builds public trust, and helps to navigate conflicting interests in the energy transition. By providing evidence-based insights into future risks, opportunities, and trade-offs, it enables policymakers to design strategies that are both socially and ecologically acceptable, ensuring cross-border energy security in terms of geopolitical risks.
Systemic knowledge needs	How to develop integrated methodologies that combine ecological, social, and economic perspectives to compare energy transition scenarios effectively. There is a need for interdisciplinary approaches that connect foresight tools, risk assessments, and policy analysis in order to identify leverage points for sustainable change and a need for a better understanding of the mechanisms for the stability of renewable energy systems. Furthermore, advancing knowledge on how different scenarios interact across scales—local, regional, and global—will be crucial to ensure resilience and coherence in long-term energy strategies.
Transversal knowledge needs	How to strengthen collaboration across disciplines, sectors, and governance levels to ensure that scenario comparisons capture the full complexity of the energy transition. This includes fostering data sharing and harmonised methodologies across countries, integrating social and environmental dimensions into scenario models, and linking foresight exercises to democratic participation and stakeholder engagement.
Actionable knowledge needs	Concrete outputs are needed, such as pathways that integrate competitiveness in the nature-, environmentally and socially friendly energy transition. Also practical tools and guidelines are needed that enable policymakers to use scenarios effectively. This includes creating accessible decision-support systems, translating complex foresight results into clear policy options, and designing mechanisms for monitoring and adapting strategies over time. Pilot projects and case studies are also required to demonstrate how scenario comparisons can directly inform governance, investment choices, and societal engagement in the energy transition.

2.5 Security

2.5.1 Comprehensive security and environmental data

The security concerns relate to environmental and sustainability issues in several ways. In CASRI results, security issues related to generation and use of environmental data were present across the themes. Widely understood data security isn't just about protecting information; it's a fundamental enabler of effective risk management and environmental action (Table 14). Without it, data-driven environmental policies risk being inaccurate and ultimately ineffective or even misguided. Key considerations include ensuring data integrity and reliability for accurate monitoring, protecting

sensitive data, building trust and facilitating collaboration, for example through citizen science, and avoiding data misuse.

TABLE 14 – COMPREHENSIVE SECURITY AND ENVIRONMENTAL DATA

Proposed topic	Comprehensive security and environmental data
Description	Comprehensive data security addresses risks related to the generation and use of environmental data.
Contribution to E&S challenges	Safeguarding the accuracy and reliability of environmental data is fundamental for responding to E&S challenges. Security concerns stem from rapid technological developments, challenges related to open data, a lack of clear legal frameworks, inconsistencies of data governance, and inadequate data infrastructures and processes for sharing environmental data across international borders. Addressing security and privacy concerns builds trust among stakeholders (governments, researchers, NGOs, local communities) and increased trust fosters greater collaboration in sharing data and prevents misuse.
Transnational societal and policy relevance	Security considerations are a prerequisite for effective international environmental data sharing and cooperation – without robust data security and governance, trust erodes, collaboration stalls, and the potential for data-driven solutions remains unrealized. Collaboration requires an understanding of transnational data governance and knowledge regarding how geopolitical tensions and varying national security interests influence data sharing willingness.
Systemic knowledge needs	Comprehensive security requires a deeper, more systemic understanding of the legal, technical, and societal factors that underpin data sharing and how these factors interact to create vulnerabilities. Systemic knowledge needs relate to an understanding of legal and governance issues related to national laws and practices, optimal technical design models of complex environmental data systems across different sectors and security protocols by EPAs and other organisations, the ethical implications of data use and privacy concerns related to environmental data sharing, and liability and fair use.
Transversal knowledge needs	Transversal knowledge needs highlight a need to move beyond siloed approaches to data security. It requires fostering communication, collaboration, and adaptability across disciplines and organizational boundaries to create more resilient and responsible data-sharing practices. Recognizing and communicating links between robust data security and broader goals of environmental sustainability is essential. Rigid and siloed frameworks hinder innovation and responsiveness, highlighting the need for governance structures that are flexible and adaptable to changing threats and emerging technologies.
Actionable knowledge needs	There is a gap between high-level recommendations and practical guidance needed to implement effective security measures. Addressing them requires creating concrete resources, tools, and training programs that empower

individuals and organizations to take proactive steps to ensure the intended use of secured data. Knowledge needs include specific technical guidance on designing and implementing secure environmental data systems, learning from best practices, and skill-building and training programs (e.g. cybersecurity for environmental professionals).

2.5.2 Social vulnerabilities of multi-scaled climate adaptation

Climate adaptation is a security issue that directly falls under the typical mandate of EPAs. Integrating social considerations into climate adaptation plans is not only a matter of equity but also essential for enhancing Europe's overall security and resilience. Effective regulations should address the root causes of insecurities while ensuring social justice. By fostering inclusive and adaptive planning, Europe can build more prepared societies capable of facing climate risks and other security threats (Table 15). Streamlined and equitable regulations can enhance resilience by fostering a unified response across sectors and communities. By addressing social vulnerabilities at different levels—such as individual buildings, districts, and cities—societies can better prepare for and respond to extreme weather events like floods and heatwaves. Certain groups within society are more susceptible to the negative impacts of climate change due to their social, economic, or political status. Ensuring equitable development through concepts like sufficiency and just transition is essential to prevent marginalised communities from bearing a disproportionate burden of climate-related challenges.

TABLE 15 – SOCIAL VULNERABILITIES OF MULTI-SCALED CLIMATE ADAPTATION

Proposed topic	Social vulnerabilities of multi-scaled climate adaptation
Description	Systematically addressing social risks and vulnerabilities related to climate adaptation actions. A broad understanding exists of how economic and social systems contribute to social vulnerabilities, often by exacerbating them. The interlinkage of these systems to actions of climate adaptation in (urban) planning are often piecemeal, leaving considerable gaps to be addressed if one were to create a larger roadmap for decision-makers to follow. A more holistic and systematic understanding of the impact of urban climate adaptation on social vulnerability would create a clearer picture for decision-makers.
Contribution to E&S challenges	Sufficiency concepts and just transition frame the desired impact of climate adaptation in urban areas. However, the desired transition must also explicitly address social dimensions, which are essential for ensuring broad societal acceptance. This includes deeper insights into processes of societal engagement, as well as aspects of socio-ecological justice. From the building level regarding urban renovation and energy retrofits, to the district level with the creation of urban green spaces and the potential for district-wide gentrification, to city-level impacts of policy goals: the problem being tackled here is to coherently understand the impact and interaction of these actions for equitable and just development for heterogeneous socioeconomic groups. Only by having a full view of social vulnerabilities caused or exacerbated by urban processes can just transition be achieved.

Transnational societal and policy relevance	Climate change poses a common challenge, but local adaptation needs are highly variable and dependent on socio-ecological context. Comprehensive strategies that are both practical and just need to be developed through cross-disciplinary and cross-country collaboration.
Systemic knowledge needs	Addresses Green Deal goals (renovation wave, climate adaptation) with social dimension.
Transversal knowledge needs	Collaboration between various levels of government and involvement of civil society and private sectors is crucial for tailored and effective climate adaptation strategies. Involved EU policy (New European Bauhaus, climate neutrality, Nature Restoration Law), national agencies (looking for general societal impact), cities, and communities.
Actionable knowledge needs	Outputs include roadmaps for social acceptance for climate adaptation measures

2.6 Democracy and participation

2.6.1 Inclusive science-policy-practice interface

Meaningful participation and democratic processes are essential for effective societal action on sustainability. CASRI results underline that the science-policy-practice interface must evolve beyond unilinear science communication and embrace interactive models that actively involve citizens and societal actors (Table 16). Science-policy-practice interfaces (SPPI) refer to the interfaces and exchange processes between scientific research, political decision-makers and practical actors (e.g. administration, civil society, business). The aim of these interfaces is to prepare and communicate knowledge in such a way that it supports relevant political decisions and practical implementation. For EPAs, this creates an opportunity: to act as trusted intermediaries between science, policy, and practice. Their role could be to build platforms for inclusive dialogue, ensure transparency, and adapt communication to local contexts. By fostering trust and collaboration, EPAs can help align scientific insights with societal needs and to present this information in a form that enables informed and effective political decisions.

TABLE 16 – INCLUSIVE SCIENCE-POLICY-PRACTICE INTERFACE

Proposed topic	Inclusive science-policy-practice interface
Description	The development of a broad, inclusive SPPI is essential for finding viable solutions and building trust in science if sustainable transformation is to be achieved. It is necessary to ensure and evaluate that different perspectives are considered in order to avoid deepening societal divisions in rapid transformation processes. It is important to address the challenges of inclusive policy interfaces. How should interfaces and exchange processes between scientific research, political decision-makers and practical implementation be structured?
Contribution to E&S challenges	Implementing policies aimed to tackle complex socio-ecological challenges requires shared understanding of key problems and wide-based acceptance of proposed solutions.

Transnational societal and policy relevance	Many environmental and climate goals are cross-cutting issues and require effective interfaces between science (the various disciplines), political actors and practitioners responsible for implementing environmental and climate policy. This is necessary in order to achieve successful and efficient environmental and climate protection. Ensuring these interfaces is critical to the success of the Green Deal's objectives.
Systemic knowledge needs	Environmental and climate issues cannot be viewed in isolation. Various systemic interrelationships form the framework for successful environmental and climate protection. These systemic interrelationships must be taken into account when designing SSPIs. Siloed structures and the need to engage various societal sectors and levels of governance remain significant challenges. The development and employment of expertise in communication, interaction and knowledge co-creation, capable to effectively addressing systemic variability and bridging silos, is essential.
Transversal knowledge needs	Coordinated collaboration and creation and formal support of collaborative networks encompassing government agencies, academic institutions, and third-sector organizations is needed. These networks should be explicitly designed to facilitate knowledge exchange and resource allocation, ensuring their longevity despite policy changes.
Actionable knowledge needs	Focused engagement and empowerment of local businesses and communities are vital for ensuring that R&I directly addresses local needs and contributes to a just and sustainable transition. Targeted training and resource provision should facilitate meaningful citizen participation, involving vulnerable or marginalized groups.

2.6.2 Integrating environmental and health data for socially just urban transformation

Co-creative and participatory use of integrated environmental and health data offers a more focused case for EPAs, especially focusing on urban settings (Table 17). Urban areas face overlapping crises related to health—climate risks (heat, flooding), air and noise pollution, car over-dependence, and social inequalities (e.g., energy poverty, lack of access to green space). Authorities and policies often address these issues in silos, missing clear opportunities offered by more holistic solutions.

TABLE 17 – INTEGRATING ENVIRONMENTAL AND HEALTH DATA FOR SOCIALLY JUST URBAN TRANSFORMATION

Proposed topic	Integrating environmental and health data for socially just urban transformation
Description	This topic is dedicated to the development of integrated tools and governance models that combine environmental and health data to guide holistic, just urban transformation strategies. The correlations between elements of the urban environment upon the health effects of the residents and users are to be more robustly understood. Through this innovative research, more guidance on improving human health through actions in urban areas are aimed for. To ensure that the results are recognized by the public, co-development methods are recommended to be applied.

Contribution to E&S challenges	Co-develop and pilot urban planning support systems combining environmental quality data (air pollution, noise, microclimate, biodiversity, soil quality) with health and socio-economic data. Using this, authorities and cities can identify and prioritize actions for improving health—such as greening, mobility redesign, building retrofitting—in ways where environmental and health co-benefits are highest. A focus is placed on low-income and vulnerable groups. This includes developing actionable indicators and visualization tools (e.g., urban health dashboards) to support targeted funding and inclusive planning.
Transnational societal and policy relevance	Special consideration is needed for addressing challenges in vulnerable groupings (i.e. social groups) and settings (i.e. urban situations). Acknowledgement of different local contexts and needs through participatory approaches is a necessity to ensure place-specific insights. This requires a dedicated diversification of research actions in various social and urban settings. Not to be ignored is the potential benefit from transnational collaboration when comparing research methods, results and solutions found.
Systemic knowledge needs	This topic has links to goals of the European Green Deal (e.g. pollution-free environments, climate adaptation, biodiversity, circularity). It further connects CASRI research demands with a focus on public health outcomes and social justice principles.
Transversal knowledge needs	The coordination of health-related research involves not only EU policy (e.g. Zero Pollution, EU Urban Greening) but also the activities of national agencies (e.g. especially the EPAs, but also relevant health authorities) and the cities and communities in which the challenges are to be found and solutions to be implemented.
Actionable knowledge needs	Outputs include pilot-tested data tools, use cases, policy guidance, and training modules for a multitude of target groups, mainly for the EPAs, national health authorities and target municipalities.

2.7 Regulatory efficiency and competitiveness

2.7.1 Smart, adaptive and effective regulation

The CASRI results highlighted that enhancing regulatory efficiency and fostering competitiveness within a sustainability transformation requires a strategic rethinking of governance structures, tools, and incentives (Table 18). At the core is the need for smart, adaptive regulation that supports innovation while reducing unnecessary administrative burdens. The importance of consistency, simplification and clarity was emphasised. Regulations should be designed with actionable and transparent rules, especially for funding instruments, to reduce uncertainty and encourage long-term innovation. This includes conducting better ex-ante and ex-post impact assessments and ensuring their effective utilisation, as well as identifying outdated – or even redundant or harmful – regulations. Thoughtful use of digital tools and AI offers potential for regulatory innovation, streamlining bureaucracy and enhancing information processing.

TABLE 18 – SMART, ADAPTIVE AND EFFECTIVE REGULATION

Proposed topic	Smart, adaptive and effective regulation
Description	Smart, adaptive, more integrated and effective regulation aims to successfully navigate fragmented, incoherent and rapidly changing policy landscapes with a data-driven, flexible and participatory approach.
Contribution to E&S challenges	Comprehensively responding to all key E&S challenges. Ensuring effective use of available data and knowledge. Guiding regulative attention and action to the most pressing questions in a just and efficient manner and ensuring that non-intended effects of regulation are effectively avoided.
Transnational societal and policy relevance	Reducing regulatory burden while at the same time improving the capacities of regulatory frameworks to respond to changing environmental conditions, economic realities, public concerns, and technological advancements.
Systemic knowledge needs	Addressing the systemic mismatch between formal, top-down regulation and informal social norms and cultural practices. Ensuring that the best practices are adopted across different sectors and policy domains.
Transversal knowledge needs	Managing complex, polycentric regulative contexts and equipping policymakers with tools to navigate multi-level and multi-actor systems.
Actionable knowledge needs	Addressing weak enforcement and implementation gaps of environmental and sustainability policies and regulations. Improved implementation and utilisation of ex-ante and ex-post assessments, cross-sectoral impact evaluations. Development of digital tools for regulatory simplification and learning labs for testing new governance models in real-world settings. EPAs should build internal capacity to harness these tools effectively, while also ensuring precaution and testing and refining new approaches through controlled experiments

2.7.2 Governance for sustainable competitiveness

In addition to the concrete need to improve regulatory efficiency, the CASRI results highlight the necessity to reconsider fundamental assumptions related to efficiency and competitiveness from the perspective of environmental sustainability and sufficiency (Table 19). The vision behind regulatory efficiency must be clear: governance for sustainability should aim for long-term transformative change rather than merely reducing short-term costs or enhancing efficiency. This requires aligning regulation with long-term sustainability goals while ensuring co-benefits for society, industry, and the environment. Multi-level governance is essential in this process. Principles such as subsidiarity and proportionality are key considerations when addressing the European level of integration for specific issues. A balanced approach that combines EU-wide frameworks with local knowledge can enhance both efficiency and legitimacy. Societal learning and cross-disciplinary collaboration, involving legal, environmental, social, and economic expertise, are needed. The regulatory paradox—where overly streamlined regulation becomes more costly over time—underscores the need for proactive, forward-looking policy design. Notably, individual behaviour change is essential but insufficient on its own. Policy interventions are required to create enabling environments since existing societal

norms and structures often perpetuate unsustainable consumption patterns. Understanding who benefits from regulation and how is key to ensuring that policies are efficient, just, and inclusive.

TABLE 19 – GOVERNANCE FOR SUSTAINABLE COMPETITIVENESS

Proposed topic	Governance for sustainable competitiveness
Description	Ensuring a regulatory environment that fully supports action towards sustainability involves considerations of growth, sufficiency, and justice. Reconfiguring the economy towards sustainable competitiveness requires a redefinition of competitiveness and the establishment of regulatory frameworks for sustainable production and consumption.
Contribution to E&S challenges	The traditional paradigm of competitiveness in terms of economic growth is challenged in the context of polycrisis. Overconsumption and rebound effects require a fundamental re-thinking of the economic system's capacity to achieve ecological sustainability in a socially just manner.
Transnational societal and policy relevance	Sufficiency and justness as key questions for competitive economies. The relevance extends to finance, marketing, regulations including EU taxonomy. Focus areas include sustainable consumption, (dis)incentives for overconsumption, sustainable finance, inequalities and social science approach on just transition.
Systemic knowledge needs	Focus is on regenerative economic paradigms across all sectors of society. This involves identifying the long-term impacts of economic activity and developing transitional strategies to address potential economic and social disruption associated with a sufficiency-based transition. Clear definitions and benchmarks for sufficiency are needed in different sectors (housing, mobility, goods).
Transversal knowledge needs	Implications span all societal sectors and levels of governance, from international trade to local economies. Development of corporate governance and public-private collaborations through mission-oriented industrial policies for sustainability.
Actionable knowledge needs	Developing wellbeing indicators and policy targets that emphasize social and environmental well-being over economic growth. Addressing the psychological drivers of consumerism and attachment to unsustainable lifestyles requires collective action and social innovation to overcome deeply ingrained norms and barriers to sufficiency.

2.8 Digitalisation

2.8.1 Capacities for advanced data generation and utilisation

Despite momentum for green and digital transitions, digitalization has been an underrepresented theme within the CASRI process, often viewed as a force for EPAs to react to rather than actively shape. In CASRI results, digitalisation was mostly an underlying theme, often referred indirectly and embedded within the other themes. However, technologies like machine learning, generative AI, augmented reality and digital twins are increasingly transforming environmental data collection and

knowledge generation and utilisation. Digitalization offers opportunities alongside challenges related to big data and information overflow, dis- and misinformation, privacy and transparency. CASRI results emphasize a shift from simply adopting new technologies to deploying them strategically and responsibly within specific management contexts, requiring EPAs to invest in capacity building for effective and ethical implementation (Table 20). Using and adapting novel and potentially fallible tools such as generative AI should be approached with appropriate caution to ensure responsible use, and, should such tools become more mainstream, EPAs are key in assessing and addressing their significant environmental footprint related to their use and infrastructure (Usman & Zakir 2025). A high diversity of potential uses of digitalised, advanced information technologies highlights the need for concerted efforts to integrate such technologies into existing systems across sectors and different levels of governance when feasible and considered necessary. This also includes collaboration between governments, private enterprises, NGOs, and educational and research institutions, where EPAs might have a coordinating role.

TABLE 20 – CAPACITIES FOR ADVANCED DATA GENERATION AND RESPONSIBLE UTILISATION

Proposed topic	Capacities for advanced data generation and responsible utilisation
Description	Developing digital capacities for streamlined systematic environmental and sustainability monitoring, data integration, and tailored decision support tools.
Contribution to E&S challenges	Capacity-building and development of policy-relevant data tools and decision support capable of fully employing data from advanced environmental monitoring. EPAs have a specific opportunity to safeguard data access and ensure long-term storage, while considering the legal, security, and ethical considerations related to the use of environmental data and data privacy.
Transnational societal and policy relevance	Learning from frontrunner countries and cases. Advanced (cross-border) monitoring and data utilisation ensures that ES R&I takes full advantage of digitalisation. Learning relates not only to digital technologies but also to their coordination, networking, human skills, impact assessment of digital changes (on governance and society), and data literacy.
Systemic knowledge needs	Development of integrative monitoring capable of addressing both the specific systemic developments and interactions between different environmental issues and sectors.
Transversal knowledge needs	Improved interfaces and digital infrastructures to improve dataflows between different sectors, organizations, and spatial scales. Facilitating collaboration between governments, private enterprises, NGOs, and educational and research institutions, where EPAs might have a coordinating role.
Actionable knowledge needs	Tools, monitoring, and data must be designed with users in mind. This includes standardizing data across countries, promoting open science, and ensuring that digital tools serve real-world needs. Developing digital capacities to tackle information overload and misinformation.

2.8.2 Environmental sustainability of digital transformation

There is a tension between using digital tools for sustainability and ensuring the sustainability of digital systems themselves. This dual perspective is crucial as EPAs navigate the environmental and societal costs and benefits of digital infrastructure. In CASRI results, environmental sustainability of digital transformation was a cross-cutting and mostly latent theme. Digitalisation represents both a transformative opportunity and a complex challenge. Digitalisation directly affects both production chains and consumption patterns. Indirectly, it affects knowledge generation and use related to all environmental and sustainability issues potentially allowing either radically increased consumption and material use or emergence of new kinds of environmentally friendly production and consumption patterns. While direct energy and material consumption of building and maintaining new digital infrastructure has already received considerable attention, indirect effects remain poorly understood (Table 21).

TABLE 21 – ENVIRONMENTAL SUSTAINABILITY OF DIGITAL TRANSFORMATION

Proposed topic	Environmental sustainability of digital transformation
Description	Ensuring environmentally friendly digital transformation of societies.
Contribution to E&S challenges	Identification and management of positive and negative effects of digitalisation on E&S challenges, including energy and resource efficiency.
Transnational societal and policy relevance	Creating comprehensive cross-border understanding the environmental effects and sustainability implications of building and maintaining digital infrastructures, including energy and resource use and emissions during the estimated operational lifespan of the technologies in question.
Systemic knowledge needs	Identification effects resulting from the use of digital technologies across different systems (e.g. transport, energy, housing, food).
Transversal knowledge needs	Understanding the positive and negative environmental effects of digitalisation from government level to individual consumer choices. Capacity-building inside EPAs and across different levels of governance.
Actionable knowledge needs	Creating understanding of the most suitable future role of EPAs in digital transformation. Means for rapid and meaningful employment of existing digital technologies and scaling up of experiments. Development of policy-relevant data tools and sustainable digital infrastructures. Development of coordination, networking, skills, impact assessment of digital changes (on governance, on society), data literacy, urban services.

3. Summary and outlook

This report has selected and shortlisted key topics in environmental and sustainability research and innovation, aimed at supporting the CASRI matchmaking process with funders. The shortlisted topics are based on transnational key issues identified from priorities expressed by expert stakeholders from fourteen European national and regional contexts. Together with other stakeholder and expert insights, the topics also serve as building blocks for a European-level Strategic Research and Innovation Agenda.

The selected topics provide a rich overview of current R&I needs and opportunities. Together, they cover the eight relevant environmental sustainability themes identified in previous phases of the CASRI project. Each individual topic addresses actionable, systemic, and transversal knowledge needs relevant for sustainability transition. To be societally relevant, the topics address current short-, medium-, or long-term societal and policy concerns and developments. The topics are relevant at a cross-national European level while remaining sensitive to regional and local contexts. Finally, the topics align with the science-based understanding of global environmental and sustainability challenges.

This listing should not be interpreted as definitive or exclusive but is open to additions and modifications arising from new knowledge and emerging issues resulting from changes in society and the environment. The original data produced by the bottom-up process of CASRI (Firus et al. 2024; Maring et al. 2025; Lyytimäki 2025a) relied heavily on the expertise of the selected key national stakeholders of participating countries and regions, and therefore did not cover all European countries. Importantly, perspectives of the Global South are largely missing from the data focusing on the different European contexts. Furthermore, it is likely that relevant issues can be found outside the limited number of shortlisted topics highlighted here. The prioritization method combining quantitative assessment with qualitative interpretations was aimed to guarantee a balanced selection of topics, representing both frequently mentioned key issues and latent topics that may be only indirectly referred when individual priorities are outlined under specific national settings. While the quantitative approach is suitable to identify topics related to more concrete, physical, and material changes and how those changes can be adopted (across levels, actors, and at implementation sites), the qualitative approach is suitable for identifying cross-cutting issues that may be referred indirectly or obscurely.

During the next phases of CASRI, the topics will be prioritized and refined to support the matchmaking process with funders, addressing needs and opportunities at the national, European, and international levels.

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